

Astronomy: Earth and Space Systems

8-4 The student will demonstrate an understanding of the characteristics, structure, and predictable motions of celestial bodies. (Earth Science)

8-4.4 Explain the motions of Earth and the Moon and the effects of these motions as they orbit the Sun (including day, year, phases of the Moon, eclipses, and tides).

Taxonomy level: 2.7-B Understand Conceptual Knowledge

Previous/Future knowledge: Eclipses are a new concept to the content at this grade level. In 4th grade (4-3.5), students explained the effects of the rotation of Earth. The effect on the length of a shadow based on the position of the Sun in the sky during the day was studied in 4th grade (4-3.7). In 1st grade (1-3.4), the patterns of change in the Moons appearance were illustrated but not related to motion. In 4th grade (4-3.6), students illustrated the phases of the Moon and the effect of the Moon on tides but not the Sun's effect.

It is essential for students to know that Earth and the Moon both revolve and rotate and these motions have effects that can be observed on Earth.

Day

- A *day* is based on the 24 hours it takes Earth to rotate.
- Earth rotates on its *axis* counterclockwise from west to east; as a result, the Sun appears to rise in the east and set in the west.

Year

- A *year* is based on the 365¼ days it takes Earth to revolve around the Sun.
- Earth revolves around the Sun in an *elliptical orbit*.

Lunar Movement

- The Moon revolves with Earth around the Sun as the Moon is revolving around Earth.
- The Moon revolves around Earth in 29½ Earth days.
- Similarly to Earth, as the Moon revolves, it is rotating or spinning on its axis.
- The rotation time for the Moon is a little over 27 Earth days.
- Because the Moon rotates and revolves in nearly the same amount of time, the same side of the Moon always faces Earth.–

Phases of the Moon

- As the position of the Moon changes as it revolves around Earth, the observations of the Moon from Earth are seen as *phases* (new moon, waxing crescent, first quarter, waxing gibbous, full moon, waning gibbous, third quarter, waning crescent)
- The cause of the *phases of the Moon* depends on how much of the sunlit side of the Moon faces Earth.

Eclipses

- *Eclipses* of the Sun and Moon are a result of an alignment of Earth, Sun, and Moon.
- A *solar eclipse* occurs when the Moon is directly in-between the Sun and Earth, blocking the Sun's light casting a shadow over a certain area on Earth.
- A *lunar eclipse* occurs when Earth is directly in-between the Sun and the Moon, blocking the Sun's light so that Earth's shadow hits the Moon casting a shadow over the Moon.

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Tides

- *Tides* are changes in the surface levels of Earth's ocean water caused by the effects of the Moon's and Sun's gravity on Earth. The effects of tides are most noticeable along ocean shorelines.
- As the Moon orbits Earth, the waters of Earth closest to the Moon bulge outward toward the Moon; this bulge is the *high tide*. Another high tide occurs on the opposite side of Earth. *Low tides* occur in the areas between the two high tides.
- When the Sun and the Moon are aligned the high tides are higher and the low tides are lower; these are called *spring tides*. When the Sun and the Moon are at right angles to each other, the high and low tides, there is the least difference in the tidal range at the shore; these tides are called *neap tides*.

It is not essential for students to know the various calendars that result from interpretation of Earth's day and year or the lunar cycle calendars, or about time zones around Earth.

Assessment Guidelines:

The objective of this indicator is to *explain* the motions of Earth and the Moon and the effects of these motions as they orbit the Sun; therefore, the primary focus of assessment should be to construct a cause-and-effect model of Earth and lunar movements with their results. However, appropriate assessments should also require students to *interpret* diagrams of the movements or the effects that result from the movement; *illustrate* the phases of the moon in sequence; or *identify* periods of time related to Earth or lunar movements.